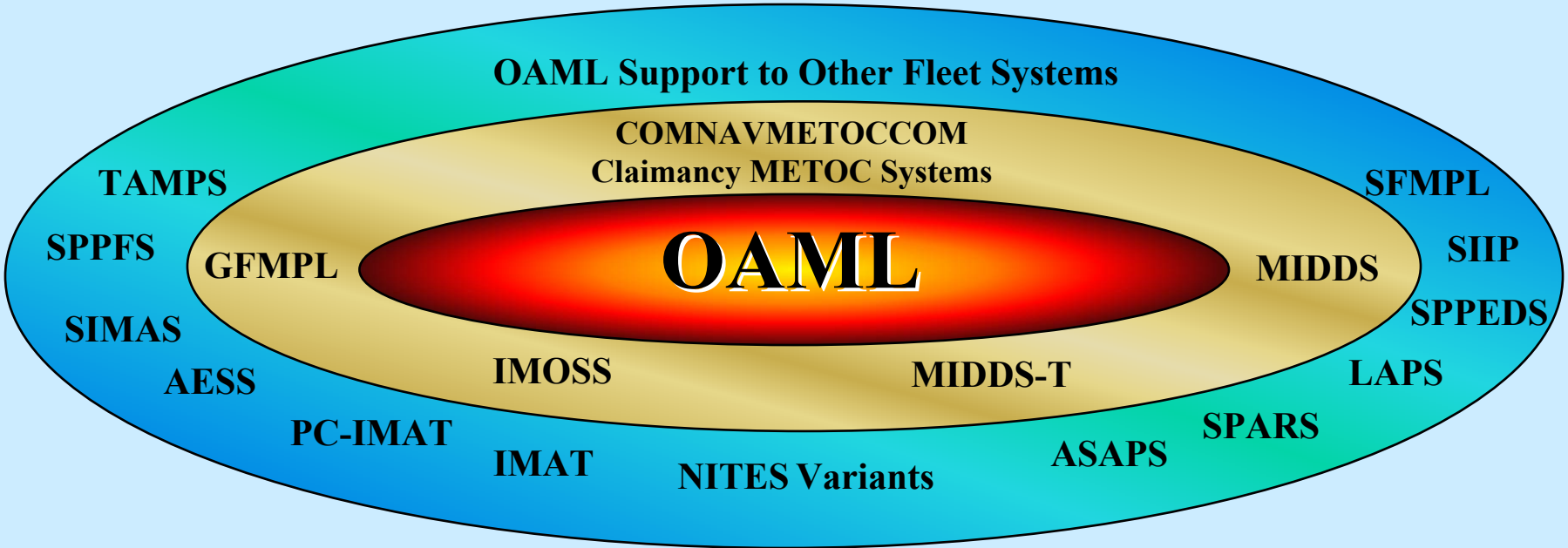
Commander
Naval Meteorology and Oceanography Command
Stennis Space Center, Mississippi

in association with

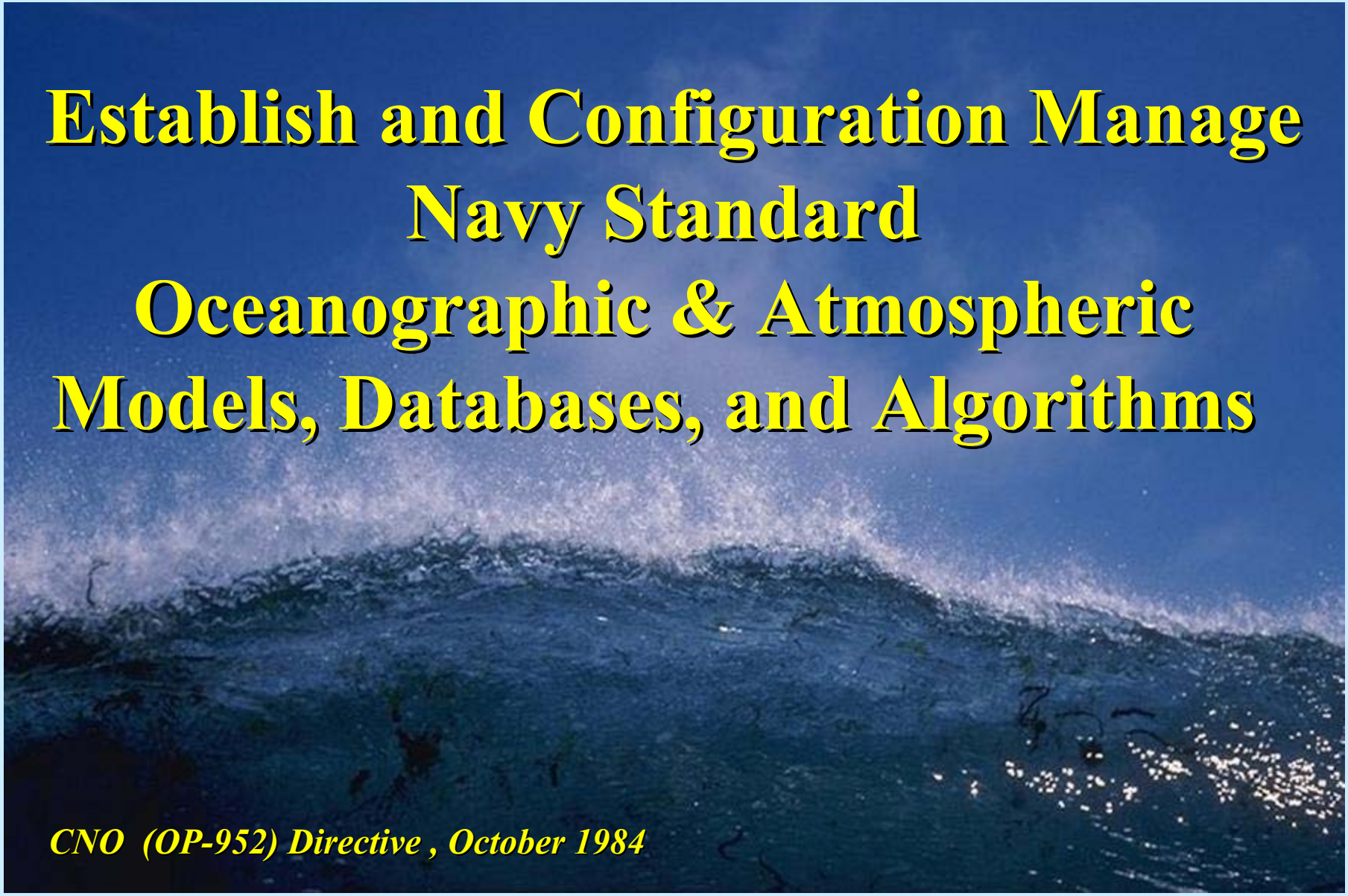
The Naval Oceanographic Office
Stennis Space Center, Mississippi

Oceanographic and Atmospheric Master Library (OAML)

- **Origin:** Established in 1984 by Chief of Naval Operations (CNO N096)
- **Charter:** Establish Navy Standard Algorithms, Models, and Databases; Establish a Repository; Promulgate Product Consistency to Satisfy Operational Fleet Requirements and CNO Objectives through a Standardized Configuration Management (CM) Process
- **Configuration Manager:** Commander, Naval Meteorology and Oceanography Command
- **Support Staffing:** NAVOCEANO, Systems Integration Division, Code N64
- **Impact:** COMNAVMETOCCOM Claimancy On-Scene Environmental Prediction Systems
  CNO-sponsored Environmental Systems and Tactical Decision Aids
  Navy R&D Labs and Academic Research Institution Product Development
  Modeling and Simulation (M&S) Training Systems Support
  Joint DoD Systems Support Activities
  NATO Systems Support
  Naval Oceanographic Office "Core Mission" Support



Primary Directive



"WHAT AND WHY"

WHAT is the OAML?

- **A Library of Core Models, Algorithms and Databases Designated by the CNO as *"Navy Standards"* to support *"Operational"* Fleet Environmental Prediction Systems.**

WHY is an OAML Needed?

- **To ensure the "Warfighter" is provided with *"CONSISTENT"* and *"CREDIBLE"* Environmental Products.**

MANAGEMENT OF THE OAML VV&A PROCESS

I. Organizational Structure and Relationship

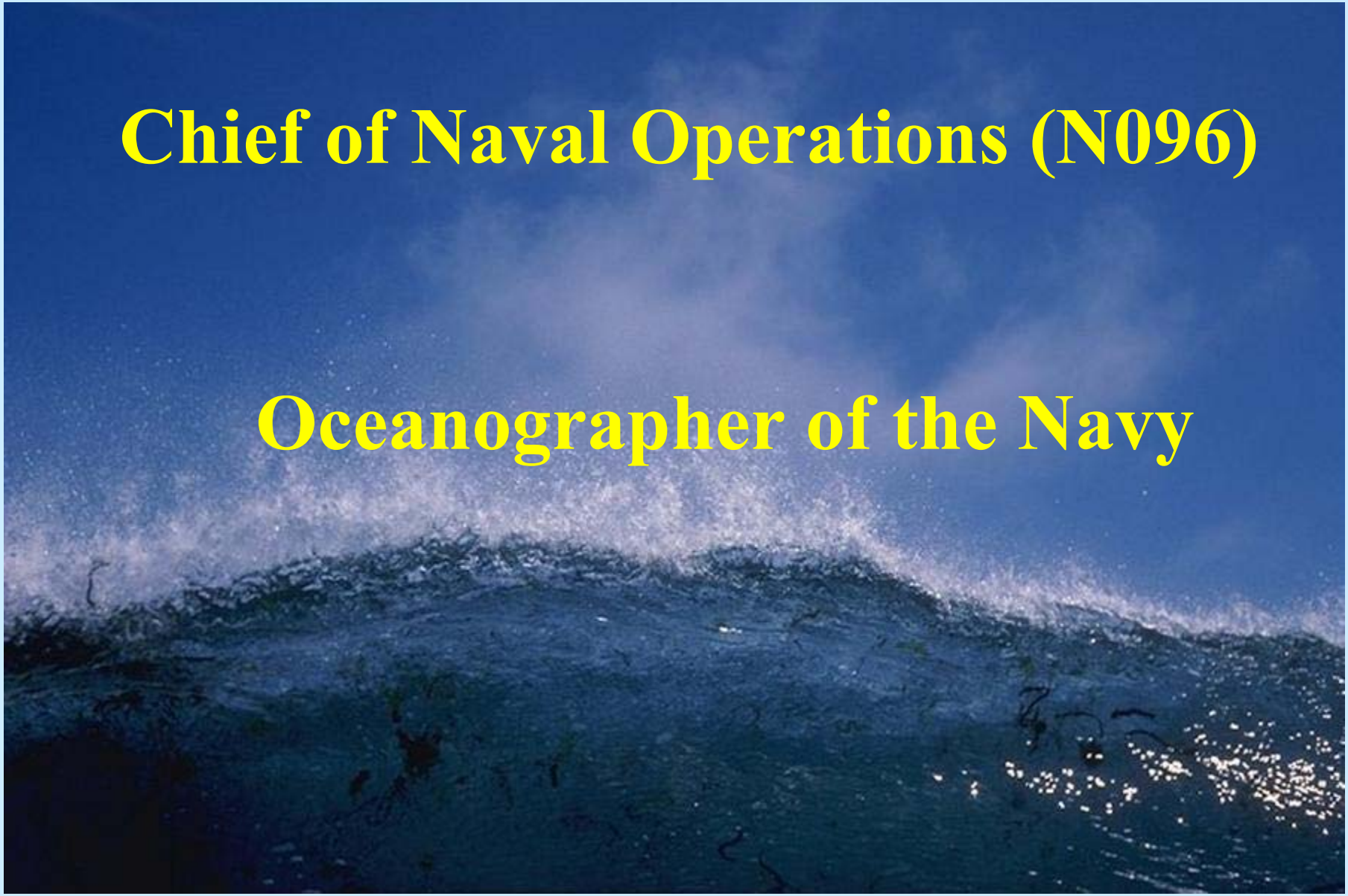
a. Accreditation Authority

b. Accreditation Agent

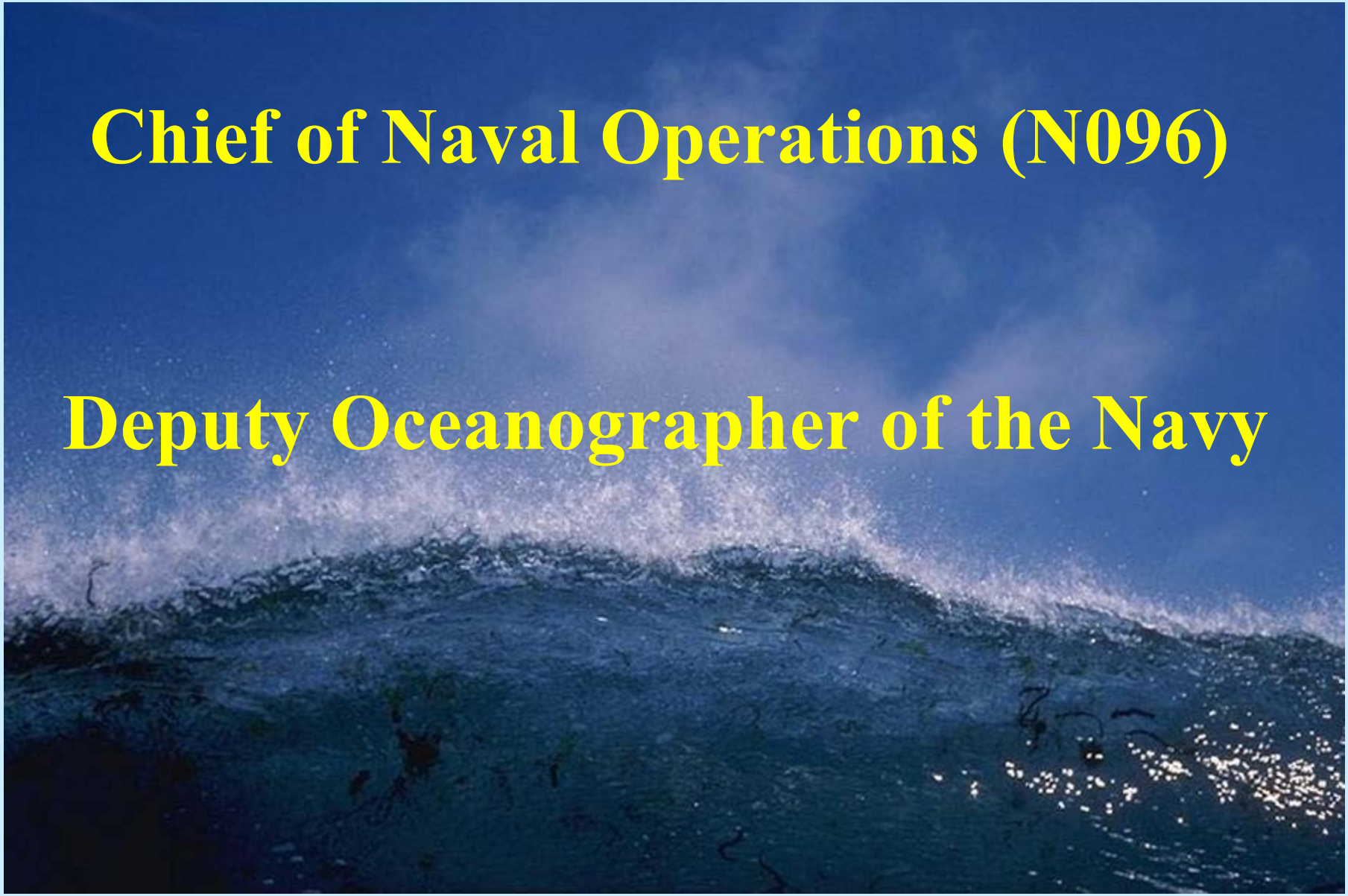
c. V&V Agents

d. Team Composition

OAML ACCREDITATION AUTHORITY

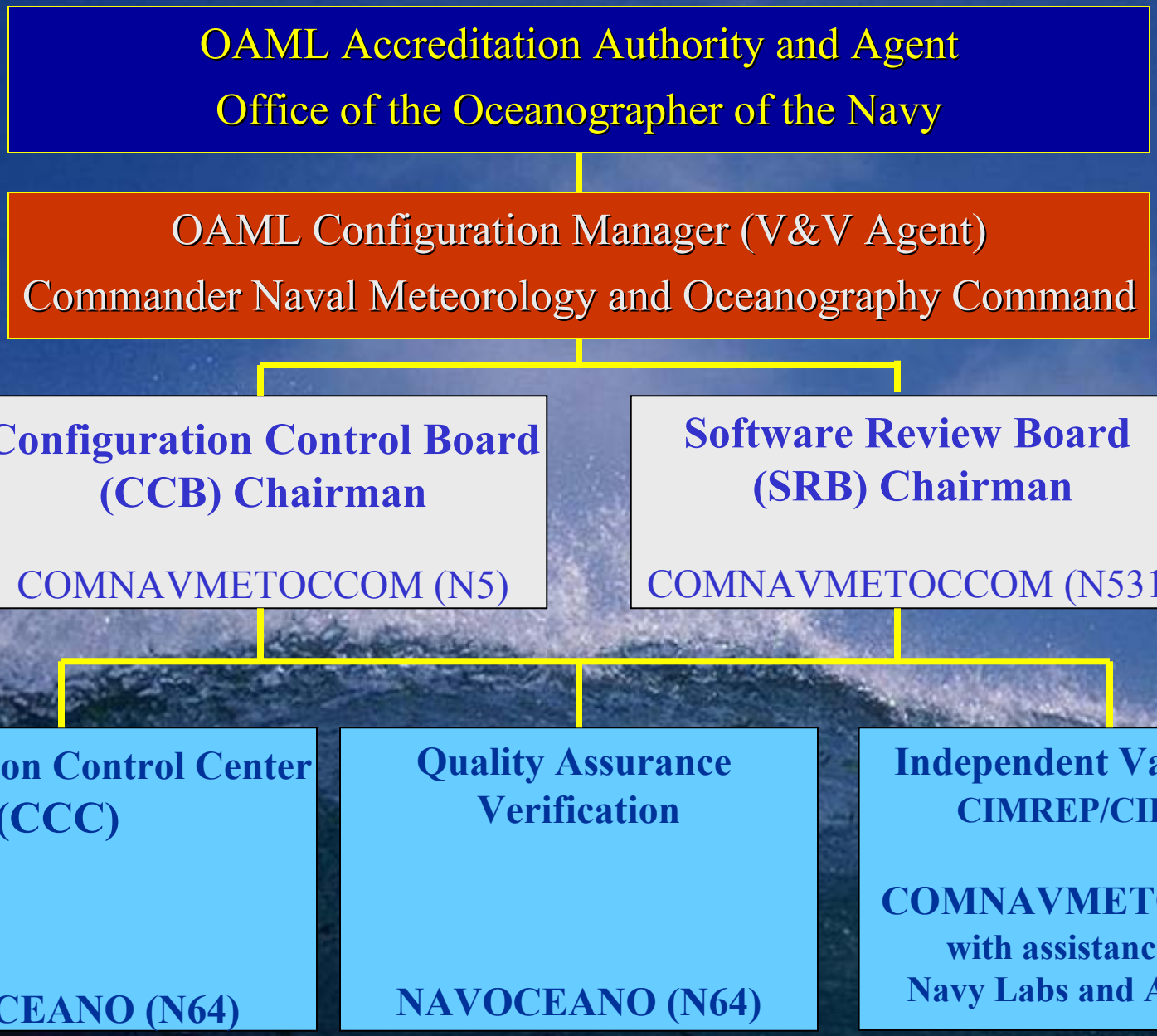


OAML ACCREDITATION AGENT



OAML VERIFICATION / VALIDATION AGENTS

OAML TEAM COMPOSITION



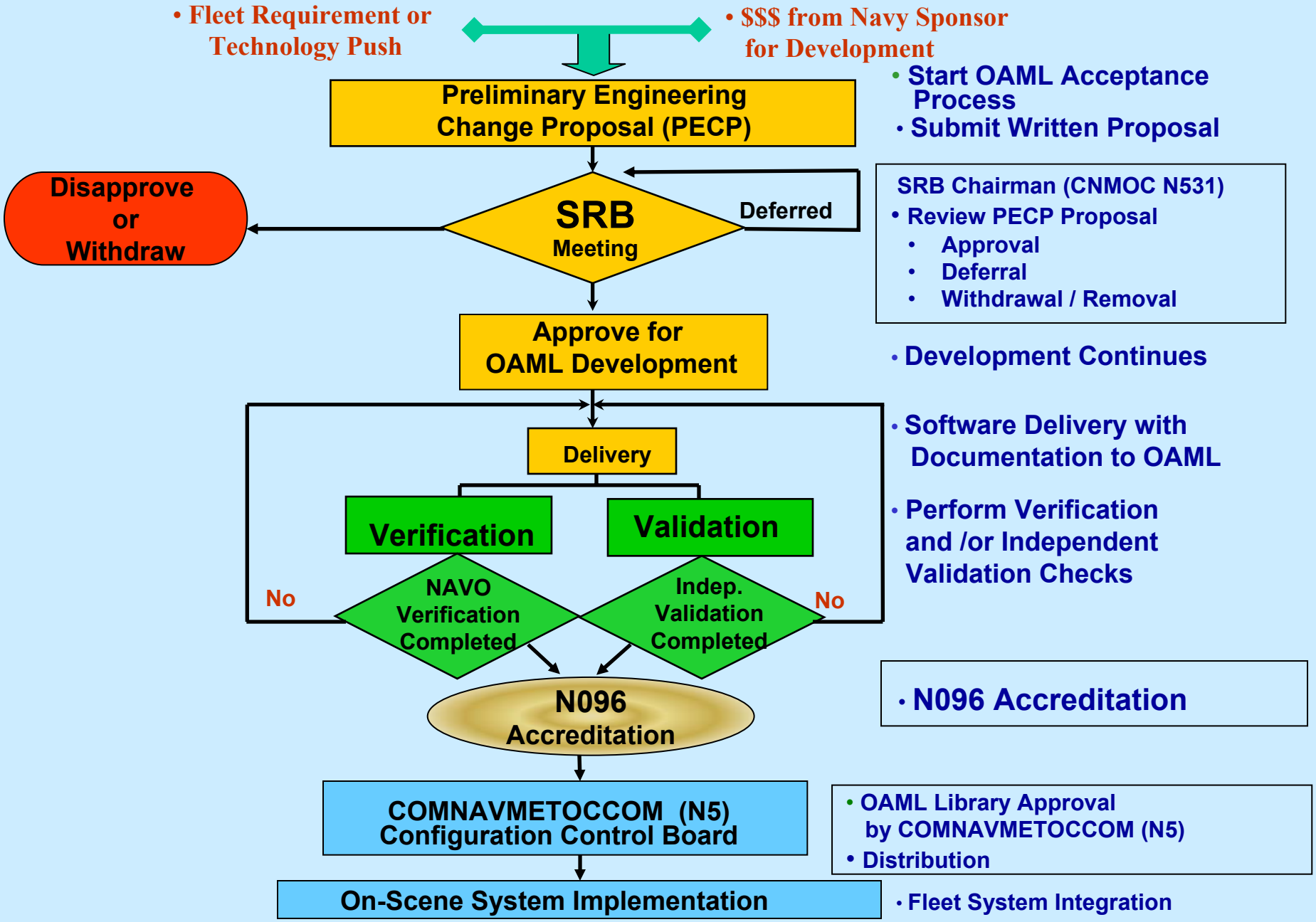
Program Structure

II. Program Structure

- **a. M&S Programs (New Development, Legacy, Federation)**
- **b. Defining M&S Requirements**
- **c. Intended Use of Models and Simulations**
- **d. Risk Management**
- **e. Configuration Management**

Note: Items a - d not directly applicable to OAML

OAML CONFIGURATION MANAGEMENT



VV&A PROCESSES

III. VV&A Processes

- a. Conceptual Model Verification and Validation
  - 1. Validating Requirements
  - 2. Validating Data
- b. Functional Verification
- c. System Verification and Validation
- d. Result Validation
- e. Data Verification and Validation
- f. Documentation
  - 1. V&V Documents Generated
  - 2. Other Documents Required for V&V
- g. Other Complementary V&V Efforts
- h. Lessons Learned
- I. Impact of Not Doing VV&A

VALIDATION

Validation (Defn.):

Whether the Requirements and final "As-Built" Software Product fulfills its specific intended use.

Reference: IEEE Standard for Industry Implementation of International Standard ISO/IEC 12207: Standard for Information Technology - Software Life Cycle Processes, March 1998.

VALIDATING REQUIREMENTS

Validating Requirements

- **Source: CNO's METOC Requirements List**
  - **Provides METOC-related items needed by the Fleet**
  - **OAML Engineering Change Proposals are based on this list**

- **Enhancements (updates/upgrades) to existing OAML products are formally proposed at bi-annual Software Review Board meetings**

- **The SRB Chairman determines proposal validity either by himself or from technical working group feedback**

VALIDATING DATA

Does the software accurately represent the *"real world"* for the purpose it was intended?
And how much *"confidence"* should be placed on this assessment?

- **The SRB Chairman determines if a *"Technical Evaluation"* is required**

Validation Mechanisms:

CIMREP (models & algorithms) or CIDREP (databases)

Confidence Factor:

Validation Panels are "Chaired" by an Independent Academic Expert (authorative source) in the required field of discipline.

- **Model & Algorithm Physics & Mathematics and/or Database Methodologies are examined "thoroughly and objectively"**
- **CIMREP/CIDREP findings, via formal report, are provided to the SRB Chairman**

FUNCTIONAL VERIFICATION

"Do OAML Products Perform as Advertised ???"

Functional Verification (defn.):

The process of determining if the software product fulfills the requirements or conditions imposed on it by the developer in accordance with the requirements for that product.

- **The OAML Configuration Control Center (CCC) at NAVOCEANO ensures OAML products "Perform as Advertised" by performing Functional Verifications prior to Final Library Approval.**
  - **Functional Verification includes:**
    - **Documentation Reviews and Software Testing in accordance with documented Test Cases**
    - **Producing a Functional Verification formal report**

- Reference: IEEE Standard for Industry Implementation of International Standard ISO/IEC 12207: Standard for Information Technology - Software Life Cycle Processes, March 1998.

SYSTEM VERIFICATION AND VALIDATION

- After OAML Products receive their *"pedigree"* as being Navy Standard Certified, they are implemented to the Geophysical Fleet Mission Program Library - (GFMPL) at NAVOCEANO.
  It is there additional functional verification and validation occurs.

- The Systems Integration Division, a certified CMM Level 3 Division of NAVOCEANO, ensures OAML Products "Perform As Advertised". Each product test is documented IAW Process Improvement Practices governed by the Capability Maturity Model.

RESULT VALIDATION

" The Road to Navy Standard Approval for New Products"

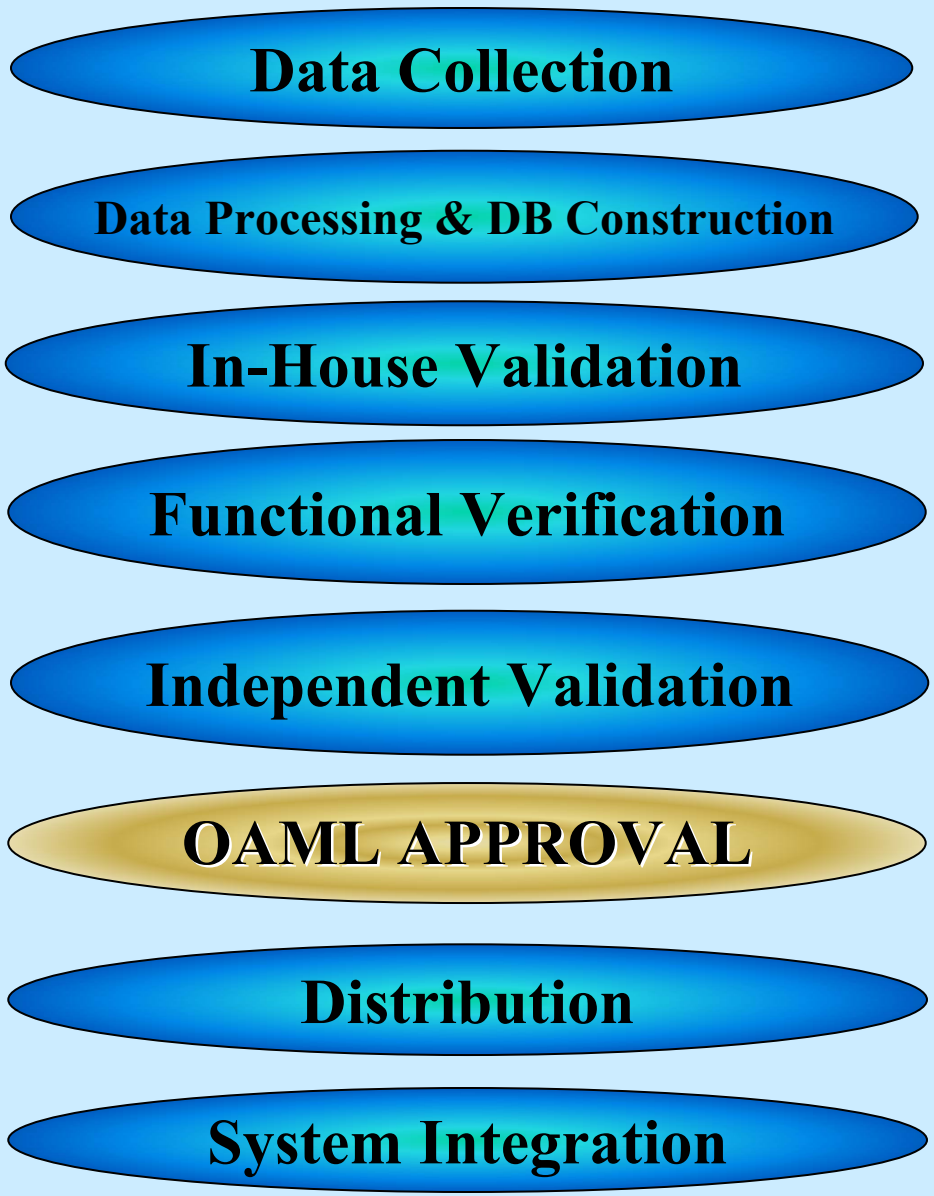
I. Validation and Functional Verification Completed
- **a. CIMREP / CIDREP Completed with Report**
- **b. Functional Verification Completed with Report**

II. Accreditation Requested by COMNAVMETOCCOM
- **a. Serial Letter sent to CNO (N096)**

III. Accreditation Granted by CNO (N096)
- **a. Serial Letter sent to COMNAVMETOCCOM**

IV. OAML Configuration Manager Approval Granted
- **a. Formal Engineering Change Proposal signed by COMNAVMETOCCOM**
- **b. Configuration Control Directive signed by COMNAVMETOCCOM**

DATA VERIFICATION AND VALIDATION



Performed by the Navy, NAVO (N3, N4, N5, N9), Academia,Contractors, Private Business and Foreign Sources

Performed by NAVOCEANO: N3, N4, N5, N9

Performed by NAVOCEANO: N3, N4, N5, N9

NAVOCEANO / OAML CCC (N64)
- Performs Documentation and Database Functional Verification

COMNAVMETOCCOM-funded CIDREPs

N096 Accreditation and CNMOC Approval

Distribution from NAVOCEANO (N64) to Systems Developers (e.g., SPAWAR, NUWC, NAVSEA, other DoD activities, R&D, Academia)

NAVOCEANO (N64) - CMM Level 3 Org.
- Implementation in GFMPL System

DOCUMENTATION

V&V Documents Generated:

- Configuration Control Board (CCB) Document, includes:
  - Signature Approved Engineering Change Proposals
  - Signature Approved CCB Directives
  - N096 Accreditation Letters
- Other Documents/Records Required to support V&V
  - CIMREP & CIDREP Formal Reports
    - Includes Operational Test Reports (on occasion)
- Functional Verification Formal Reports
- Software Review Board Document, includes:
  - Preliminary Engineering Change Proposals, Specifications, and Requirements

LESSONS LEARNED

- Following a "Rigid" Configuration Management (CM) Process pays "Big" dividends for the Fleet
  - OAML has followed the same CM Process since its establishment in 1984 with SUPERIOR Results
  - OAML's CM and V&V Process is:
    - Time Proven and Successful
    - Adaptable to other Branch Services (e.g., JEML)
- Establishing a "Pedigree" is beneficial to:
  - Operational users and M&S users
  - Software Implementors
  - System Developers /Integrators
  - Sponsors defending programs

IMPACT OF NOT DOING V&V

- **Product Quality**
  - Negative Impact on Developer Confidence
  - Products become “Inconsistent” and “Non-credible”
  - Negative Impact on User Confidence
- **Funding Impact**
  - Sponsors would have difficulty defending programs
  - Developers would have difficulty gaining funding
- **Overall Result**
  - Chaotic Product Management
  - Loss of Tactical Advantage


Questions?